

II. "Second Report on the Evidence of Fossil Plants regarding the Age of the Tertiary Basalts of the North-East Atlantic."
 By J. STARKIE GARDNER. Communicated by Sir J. D. HOOKER, K.C.S.I., F.R.S. Received November 30, 1885.

I have the honour to make known the results attending the expenditure of £75, placed in my hands by the Government Grant Committee for the purpose of investigating the fossil floras of Scotland, which has been expended at Ardtun Head.

The position and physiography of this headland in the Isle of Mull has been fully described by the Duke of Argyll. It is the point of land separating Loch Laigh and Loch Scridain, and is about two miles in circumference and a mile across.

It is composed mainly of two sheets of basalt with remains of a third sheet, on some eminences and along the shore of Loch Laigh. These are almost horizontal, with a slight dip east, up Loch Scridain, and a considerable dip in the same direction up Loch Laigh. The upper sheet is not less than 40 to 50 feet thick, crystallised into rude massive columns, now much fissured and weathered, whilst the lowest presents a thickness of 60 feet, visible above low water, the upper two-thirds being amorphous, and the rest fashioned into slender and most perfect columns, bent in every direction, like those of the Clam-shell cave at Staffa. The beds are so exceedingly horizontal towards the seaward direction, that no one can doubt the columnar basalts of Staffa and the Treshnish Isles, Geometra and the mainland of Mull, being on the same horizon, if not parts of the same sheet. Between the two great lava beds at Ardtun is intercalated a bed of sedimentary deposit, reaching a maximum of 60 feet thick, and consisting of pale very fine-grained clay and limestone at the base, then sand and gravel, black laminated shales, whinstone, gravel, and laminated sands. The gravels are made up of flint, pebbles, and subangular rolled fragments of older lava beds, in a matrix of broken-down volcanic material. They present all the ordinary lines of current bedding, beautifully weathered out, and the pebbles are drifted precisely as in ordinary river gravels.

There can be no question whatever, indeed, but that the gravels are the deposits of the waterway of a river, and the shales, its overflows and backwaters. The river must have been of some magnitude, as its deposits traverse the whole seaward face of the headland, and their extension inland seems to be marked by the occurrence of two beds of coal, which have, to a small extent, been worked, one near Bunessan and the other nearer Ardtun village. An intrusive sheet of fine compact basalt rises on one side of the head, cutting a devious way

through each bed in turn, and dipping beneath the sea at the other extremity. On the coast, near the centre of the head, occurs a small chine, apparently due to the weathering out of a vertical dyke, which has cut through the gravels and shales, and left them in a very accessible position; it was here, accordingly, that I resolved to excavate them.

With the assistance of the Duke of Argyll's energetic factor, Mr. Sinclair, men and tools and a barrel of powder were forthcoming, and after a few days' work and the removal of a mass of the intensely indurated shingle bed, to the extent of perhaps hundreds of tons, many square yards of the whinstone and the underlying black shales were exposed. The large specimens of *Platanites aceroides* and *Onoclea hebridica*, now exhibited, were the results. The new specimens of the latter, including fertile as well as barren fronds, give a very different idea of its growth to what would have been imagined from those formerly known, and we see that the pinnae were produced on very long and stout naked stems. The ravine, however, proved an unfortunate selection, for the whinstone became poorer in fossils as we got farther in, and the underlying black shales, though crowded with leaves, proved so squeezed and full of slickensides or faulted surfaces, and, consequently, so brittle as to be practically valueless for collecting purposes. The lighter limestone is wholly absent at this spot. From the condition of the shales and calcined appearance of the gravels—here of a steely-grey colour, intensely hard, with pure white and occasionally cherry-coloured flints, it is evident that the ravine must be the site of an old dyke, and if proof were wanting of a violent upthrust at this spot, it is to be found in the upturned edges of the bottom bed on the west face. The succession of beds in the section we had been so laboriously working at in the ravine, in no way prepared me for the discovery I made subsequently, that within 100 yards there existed, many feet below the lowest sedimentary bed present in the ravine, a deposit of limestone, rivalling in fineness and texture the celebrated lithographic stone of Solenhofen, and containing, as expressed by Professor Newberry, "most exquisitely preserved leaves." On removing some turf, in order to obtain a true section, I was overjoyed to find this deposit, so completely different in character to any previously seen in the basalts. It may seem strange that it should have been overlooked by the many geologists who have visited the spot; but the beds are in a very inaccessible position, and to work them dangerous, until sufficient had been worked away to afford standing room. Quarrymen could not be induced to work there at all, but two boatmen did not make any objection.

It is too early to attempt as yet to give any account of the new flora, which seems to differ considerably from that of the shales above. Very large leaves of many kinds occur in the clay at the base, which

was so friable, however, that only fragments could be secured. The leaves in the limestone are smaller and very sparsely scattered through it; there are, moreover, no cleavage planes, and hence much patience is required to obtain and develop them. I have obtained about twenty species of dicotyledon from it, the most prevalent being *Grewia crenata*, Hr., and *Corylus MacQuarrii*, Forbes, and *Acer arcticum*, Hr., all of which are also found in beds of the same age in Greenland. There are no ferns and only three conifers, a large variety of *Guilago adiantoides*, Unger, a new *Podocarpus*, the most northerly species I believe yet found, and *Taxus Campbelli*. The fragments from the clays show about eight additional species, and altogether I should judge that both floras were very rich. All the conifers occur also in the shales, and a specimen of *Guilago* has long been in the collection at Inverary. The most characteristic plants of the shales are those described by the Duke of Argyll and Edward Forbes, *Platanites aceroides* and *Rhamnites multinervis*. *Taxites Campbelli* is not, as affirmed by Heer, identical with *Sequoia Langsdorffii*, but appears to be a true *Taxus*. Some other leaves are certainly referable to *Protophyllum*, and we have representatives apparently of leaves determined as *Alnus*, *Cornus*, *Berchenia*, *Populus*, and *Corylus*—but among them there are none, so far as I can ascertain, that have ever been found in European beds of Miocene age. This is a point, however, upon which I do not wish to insist at present, farther than to say, that the flora seems to bear a *primâ facie* resemblance to cretaceous floras of America rather than to any yet known from Europe. The resemblance of the Coniferæ to those indigenous to China at the present day, is too remarkable to be overlooked.

It has become evident that the fluviatile rocks of the British basalts are of far greater extent and importance than had hitherto been imagined. Before the complete account of them, which I hope later on to prepare, can be proceeded with, their position in the series has to be fixed, their lateral extension to be mapped.

The first of these points is fortunately not difficult to settle. The base of the basalts is exposed at Burg Head on the opposite side of Loch Scridain, resting upon Jurassic rocks and fragmentary masses of chalk. The base of the series seems formed of two immense sheets of ash, the lowest of which is full of scoriæ, and about 100 feet above these, resting upon columnar basalt, in every respect similar to that of Ardtun Head, are fluviatile beds, sands and clays from 9 to 12 feet thick. Overlying these is a bed of rudely columnar basalt, and taking account of all the circumstances, there cannot be much doubt about the fluviatile series on both sides of the loch being upon the same horizon. The beds are, in fact, seen to be horizontal to the west as far as the eye can reach. The horizon of the Ardtun gravels would, therefore, seem to be about 150 feet from the base of the series.

Taking into account the superior thickness of the basalts in Mull, and above all the presence of ash beds at their base, it seems probable that they were nearer the vents than Antrim, and that their lowest beds are at least not newer, so that the Mull leaf-beds at 150 feet from the base should be much older than the Glenarm and Ballypalady leaf-beds at 600 feet from the base.

The horizontal extent of the fluvatile beds of Mull is more difficult to estimate. Gravel is mentioned as present at Loch Truadh, to the north-west, and at Carsaig to the east. In the latter locality it is, perhaps, thicker and more extensive than at Ardtun. The horizon should also be found in two of the Treshnish isles and round the north-west coast of Mull, and there can be little doubt but that deposits of plants exist in many localities besides Ardtun. Black shales, with identical leaves, have been found in Canna, and leaflets of *Taxus* or a similar foliated conifer at Uig.

Though the fluvatile beds at Bourg are unfossiliferous, a very interesting relic of the Eocene vegetation occurs there, for a large tree, with a trunk 5 feet in diameter, has been enveloped as it stood to a height of 40 feet, by one of the underlying lava beds. Its solidity and girth enabled it to resist the fire, but it subsequently decayed, leaving a hollow cylinder filled in with *debris* and lined apparently with the charred wood. There is also the limb of a larger tree in a fissure not far off. The wood proves to be coniferous, belonging possibly to the *Podocarpus* whose leaves are so conspicuous in the beds above.

III. "Addition to a former Paper on *Trichophyton tonsurans*."
("Proc. Roy. Soc.," vol. 33, p. 234.) By GEORGE THIN, M.D.
Communicated by Prof. M. FOSTER, Sec. R.S. Received
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In the "Proc. Roy. Soc.," vol. 33, p. 234, 1881, a paper of mine is published on "*Trichophyton tonsurans*."

Since the time that the investigations recorded in that paper were made, the study of parasitic fungi has been greatly facilitated by the introduction by Dr. Koch of gelatinised meat juice as a medium for cultivation, and having again studied the development of trichophyton with the advantages derived from the use of this medium, I believe that two results which I have obtained might be usefully published as a supplement to the paper referred to.

The gelatinised meat juice which I used was peptonised and neutralised, and trichophyton grew on it readily and with certainty.

In my previous experiments (in which I used vitreous humour) I had succeeded in growing the fungus when the hairs containing the